Electronic Design Automation and Fabrication
at Ferris State University

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Abstract
This paper describes the upgrading of Electronic Design Automation (EDA) tools in an Electronic Engineering Technology (BSEET) program using funding from the National Science Foundation’s Instrumentation and Laboratory Improvement Grant Program. The grant allowed replacement of existing EDA hardware and software with new EDA tools to enhance existing courses in the junior and senior year.

Ten (10) Sun Microsystems workstations coupled with Mentor Graphics EDA tools allow design, simulation, programming and layout of mixed technology systems. The mix of technology includes, microprocessors, analog devices, programmable logic devices and hardware description languages.

This enhancement has contributed to major modifications in four (4) courses of the BSEET and two (2) courses in the new Computer Networks and Systems (CNS) program. These modifications are taking place over a two year period to allow review of modifications and to make appropriate adjustments in subsequent implementations.

Introduction
Ferris State University is a state supported institution with approximately ten thousand students. The university is comprehensive with over one hundred programs from associate to doctoral level. The College of Technology provides a variety of engineering technology programs including Manufacturing, Plastics, Electrical/Electronics Engineering Technology and others. The Electrical/Electronics Department supports three degree programs; an Associate in Industrial Electronic Technology, a Bachelor in Electrical/Electronic Engineering Technology (TAC-ABET accredited) and a new Bachelor degree in Computer Networks and Systems.

Since 1988, EDA tools have been used in several classes of the BSEET program. Since the tools were in a highly integrated environment, implementation took the form of projects that started with a concept and carried the project through fabrication. Because of the age of the workstations and software, an upgrade was desired but difficult to fund. In 1993, a successful NSF-ILI grant was written to upgrade and expand this EDA capability.

EDA System
Software
The former software used was the Vanguard design system, a product of Case Technologies (now supported by Sophia Systems). This EDA environment is an integrated environment that contains schematic capture, simulation (PSpice), printed circuit layout, autorouting and document editing. This environment
has worked very well in coursework and it was desired to maintain it but also integrate more tools in other classes.

After much study it was found that Mentor Graphics EDA tools offered the widest selection of tools in an integrated environment. With the existing BSEET program and the proposed CNS program, we also felt that maintenance (we did not have maintenance on the Vanguard system due to cost) of the tools would be necessary to extend the life of our overall EDA capability. We also wanted flexibility to add tools as the proposed CNS program took shape and the BSEET program responds to industry needs.

Mentor’s tools are widely accepted throughout the industry making them valuable for a student to learn. Also, Mentor’s Higher Education Program provides tools at a cost that is affordable.

Hardware
Through partial funding from the NSF, Ferris State University and equipment trade-in allowances, a new EDA lab became reality. The hardware configuration is listed below for the laboratory:

- (3) Sparcstation 20 with 64M memory, 1 GB hard drive and graphic accelerators
- (7) Sparcstation 5 with 64M memory, 1 GB hard drive and graphic accelerators
- (1) 4 GB network hard drives
- (1) CD-ROM drive
- (1) Tape backup system
- (1) Laser printer
- (1) HP Draftpro plotter

The Sparcstations are networked together to utilize the numerous network resources.

Because we had an existing lab (7) Sun 3/60, it was possible to trade these units toward the purchase of the Sparcstations. This trade-in arrangement was a key element in getting all the funds necessary to purchase the needed equipment. It is worth noting that NSF is very accommodating in allowing substitutions, provided the original idea is maintained or improved; this flexibility allowed for upgrading to some Sparcstation 20’s at the same cost. This gives us more compute power than we otherwise would have.

Course Usage
The Mentor software is used in six different courses in the BSEET and CNS programs. These courses include the following:

**EEET 322 CAD for Electronics**
This course introduces the student to EDA tools through the vehicle of a project. The students design, simulate, lay out and fabricate a single output power supply. Although the project is not complicated, the intent is to teach usage of tools and fabrication techniques. All fabrication is done using a photographic process and the artwork is generated on a pen plotter. EDA tools used in this course include Analog Station, Board Station, and ProtoView. Students are required to turn in a functional project with documentation done on a word processor (Microsoft Word).

**EEET 412 Advance Digital I**
The use of programmable logic and microprocessors are emphasized in this course. The students program PLD’s (Lattice 2032), and incorporated them into a microprocessor design. Since this is the first,
course in a two-course sequence, students will begin a single board computer design that will be completed in the subsequent advanced digital course. EDA tools used in this course include Design Architect and Board Station.

EEET 422 Advanced Digital II
This course continues the single board computer design. Layout of a two sided board is accomplished using an autorouter and stressing the importance of manual intervention in printed circuit layout. EDA tools used in this course include Design Architect, Board Station, ARTROUTER, ProtoView and AutoTherm.

EEET 428 Senior Projects
This capstone course requires construction of a student project under the direction of a faculty member or industrial advisor. Project ideas come from students, industrial advisors and intern sites where the students may have worked. Some projects can be very complicated. Tools used in this course include Analog Station, Design Architect, Board Station, ARTROUTER, ProtoView, and AutoTherm.

ECNS 410 Digital Signal Processing
This course is under development for the CNS program that begins in the fall semester of 1996. The course will include an introduction to DSP, sampling, IIR and FIR filters. Tools being investigated for this course include Design Architect and DSP Station.

ECNS 421 Embedded Computer Systems
This new course in now under development and deals with issues pertinent to embedded control. Small scale systems, real-time operating systems and interface are topics of major concern. The design and layout of a PC/104 processor system will highlight the laboratory portion of this course. Tools that are expected to be used include Design Architect, Board Station, ARTROUTER and ProtoView.

Implementation and Results
The first course (EEET 322) offering using Mentor’s tools is winter semester 1996. Since little experience has been gained to date with students, some observations can be made about system installation and course development.

Of the ten (10) Sun workstations and peripheral equipment delivered, one workstation malfunctioned. Sun Microsystems was responsive and replaced the motherboard to correct the problem. I would have to agree with King that “Installation of software and administration of the network is a continuing job, not just a one time effort.” Many hours have been spent configuring the network and installing software to best utilize the network resources (disks, printer, plotter). Revisions of the operating system and Mentor software arrived shortly after the first installation was complete. It appears ongoing administration of the new system will consume more time than the old system. This is primarily due to fact that with updates coming on a timely basis and new product introductions, more time is needed to load the updates and new products. With the old system, no maintenance was purchased and therefore became a stagnant system. I believe that the bottom line is if one wants to keep up with current tools more time will need to be invested not only to learn the new tools but also administer them.

Course development has been going quite smoothly. However, with the many features of Mentor’s products they can be somewhat overwhelming to a new user. The on-line tutorials for the products are most
helpful but even with these a student can get confused with the many options available. To overcome this problem, a lab manual is in development to help students determine the most useful features without being overwhelmed with the details of the overall system.

**Conclusion**

Our past experience shows that students enjoy working with EDA tools. With the installation of Mentor Graphics tools we believe this trend will continue. These new tools will also play an important role in our new CNS program. With up to date tools under maintenance, more time will be needed to integrate new tools into courses as well as network administration. In the long run it is very much worth the effort to have graduates that have skills needed by industry.

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**References**


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